Science AMA Series: I'm Dr. John Barnes, team leader for the Influenza Genomics Team at the Centers for Disease Control and Prevention, I help develop better flu vaccines, AMA!

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Hi Dr. Barnes,

Would you kindly explain why the nasal flu vaccine has recently been pulled off the market? I know that it was targeted towards children, and ultimately there was an issue with efficacy, but was this problem specifically in children? A fellow graduate student in my lab worked on the development of the nasal spray vaccine at Astra Zeneca and we've been trying to really figure out what went wrong.

In addition, what are the inherent differences to consider between efficacy of a nasal spray-based vaccine versus a traditional shot?

Thank you in advance!

Edit: Based on some responses I've gotten to this question, I wanted to clarify a bit. I am interested in understanding what is specific to the nasal spray administration of the vaccine versus traditional injection of the vaccine that made it so ineffective. This is more of a technical question than a public health question. I understand the public health effects that arose as a consequence.

anonymusmusculus

Thanks for that question.

CDC's Advisory Committee on Immunization Practices, or ACIP, voted in June that the "nasal spray" flu vaccine, should not be used during the 2016-2017 flu season. This decision came after concerns that the nasal spray flu vaccine may not be working well. In late May, preliminary data on the effectiveness of LAIV among children 2 years through 17 years during 2015-2016 season became available from the U.S. Influenza Vaccine Effectiveness Network. That data showed the estimate for LAIV VE among study participants in that age group against any flu virus was 3 percent (with a 95 percent Confidence Interval (CI) of -49 percent to 37 percent). This 3 percent estimate means no protective benefit could be measured. In comparison, IIV (flu shots) had a VE estimate of 63 percent (with a 95 percent CI of 52 percent to 72 percent) against any flu virus among children 2 years through 17 years. Other (non-CDC) studies support the conclusion that LAIV worked less well than IIV this season. The data from 2015-2016 follows two previous seasons (2013-2014 and 2014-2015) showing poor and/or lower than expected vaccine effectiveness (VE) for LAIV.

As you may already know, how well the flu vaccine works (or its ability to prevent flu illness) can range widely from season to season and can be affected by a number of factors, including characteristics of the person being vaccinated, the similarity between vaccine viruses and circulating viruses, and even which vaccine is used. LAIV contains live, weakened influenza viruses. Vaccines containing live viruses can cause a stronger immune response than vaccines with inactivated virus. LAIV VE data before and soon after licensure suggested it was either comparable to, or better than, IIV. The reason for the recent poor performance of LAIV is still not completely known.

Hi Dr. Barnes, and thank you for doing this AMA.

I have always been struck by how much the effectiveness of the flu vaccine can vary from season to season. In some seasons, effectiveness may be as high as 80%, but in others it may be as low as 15%. Obviously, a lot of this seasonal fluctuation in effectiveness depends on the match between the flu vaccine and the flu viruses that are spreading and causing illness in the community, as well as the characteristics of the person being vaccinated.

It seems that your "Advanced Molecular Detection" approach is geared towards leveraging better technology to make sure that we more consistently have better effectiveness outcomes from season to season.

Can you expand a bit more on what exactly this AMD platform does that is different from the current approaches used to guide vaccine development? I have to imagine that current approaches try to use viral genomics and epidemiology to inform future vaccine development.

With this in mind, can you also walk us through what are the most common reasons that we "guess wrong" in terms of which viral strains will be responsible for the next season's flu?

Thanks!

SirT6

One example of how AMD technology is used in vaccine development is to address mutations that may occur in vaccine viruses during growth in eggs used in the production of vaccine viruses. These mutations can change the vaccine virus so much that the immune response to vaccination may not protect as well against circulating viruses. This means that vaccinated people may still get sick. CDC is using AMD technology to try to solve this problem. Scientists are looking at the genetic sequences of 10 generations of H3N2 flu viruses as they grow and evolve in eggs. CDC will test all of the viruses to find out what genetic changes cause a good immune response and good growth in eggs. Once the “good” genetic changes are identified, CDC will use will then synthesize H3N2 viruses with those properties that can be used to make vaccine that offers better protection against H3N2 flu infection. One of the main reasons that the virus is challenging, is due to its’ RNA polymerase. The polymerase of influenza is very mistake prone and causes the virus to mutate rapidly. For example, in some years certain influenza viruses may not appear and spread until later in the influenza season, making it difficult to prepare a candidate vaccine virus in time for vaccine production. This can make vaccine virus selection very challenging. We are currently using AMD techniques to sequence all clinical specimens that come into the CDC to improve our ability to find and track mutations that may be of concern.

Hello Dr. Barnes,

I am a graduate student who just began working on ancestral sequence reconstruction of RNA viruses.

I'd like to know what you were studying during graduate school and how you think that prepared you for the job you have now. I'd also like to know what qualifications/experience you are looking for in a bioinformatician. Lastly, if you have any advice on how to break into the field of viral genomics, I would very much appreciate it.

Thanks!!

maxtrillions

I never started out to work with Influenza at all. In graduate school I studies molecular biology of pine trees. However, during that time, I had the opportunity to learn about genetic sequencing technologies and functional genomic techniques and their application. In pine trees, functional genomic technologies became very popular as the Pine tree genome is massive and traditional molecular biology was difficult. When the job came open in the CDC Influenza Division in 2007 this knowledge was directly applicable, even though my experience was in a vastly different organism. Viral genomics is a very hot field right now, particularly with the increased application of NGS technologies. I work with bioinformaticians constantly, they are crucial in making the data my team generates make sense. Bioinformaticians that understand the lab work are in my opinion the most useful. As advice, I would say make sure you gain a good foundation in the lab science as well as the computational. Then you will be what we call a “unicorn”. Hope this helps.

Hello Dr. Barnes,

I am wondering if you had any thoughts on this research:
https://www.ncbi.nlm.nih.gov/pubmed/27025838

Essentially, there is growing data that serial influenza vaccination every year results in lowered vaccine effectiveness versus someone who just had it once. Those who had flu vaccinations three years in a row actually were worse off than unvaccinated participants.

I know it's not enough evidence to make firm conclusions or make practice changes, but I'd like to hear an expert's thoughts on this concerning development.

pharmacist10

Some studies suggest that flu vaccine effectiveness may be higher in groups receiving flu vaccine for the first time compared to groups vaccinated more than once. Other studies have found no evidence that repeat vaccination resulted in a person being less-protected against the flu. Most results from studies assessing the effect of repeat vaccination show that people who do not receive a flu vaccination for the current or previous season are at a higher risk of medical visits due to infection with seasonal flu viruses. Information regarding vaccination history is particularly important to these types of evaluations, and can be difficult to confirm, as accurate vaccination records are not always readily available. People who choose to get vaccinated every year may have different characteristics and susceptibility to flu compared to those who do not seek vaccination every year. These findings merit further investigation to understand the immune response to repeat vaccination and continued efforts to monitor the effects of repeat vaccination each year. However, based on the substantial burden of flu in the United States, and on the fact that most studies point to vaccination benefits, yearly flu vaccination remains the first and most important step in protecting against the flu and its complications.

What are the best efficacy rates for a flu vaccine in the best years? And what's a typical annual efficacy rate?

Clearly the influenza shot is important for at-risk populations (seniors, pregnant women), but why is it

important for other populations? Is it important for low risk populations? Do you get a flu shot every year?

areback

CDC conducts studies to measure the benefits of seasonal flu vaccination each flu season to help determine how well flu vaccines are working. While vaccine effectiveness can vary, recent studies show vaccine reduces the risk of flu illness by about 50% to 60% among the overall population during seasons when most circulating flu viruses are like the vaccine viruses. If you are interested in more information, a collection of studies on flu vaccine effectiveness studies can be found here: http://www.cdc.gov/flu/professionals/vaccination/effectiveness-studies.htm.

CDC has been working with researchers at universities and hospitals since the 2003-2004 flu season to estimate how well flu vaccine works through observational studies using medically attended laboratory-confirmed flu as the outcome. This is the U.S. Flu Vaccine Effectiveness (VE) Network. The U.S. Flu VE Network currently consists of five study sites across the United States that measure the flu vaccine's effectiveness at preventing outpatient medical visits due to laboratory-confirmed influenza. CDC's observational studies at U.S. Flu VE Network sites measure outpatient visits for laboratory-confirmed influenza infections. These studies compare the odds of vaccination among outpatients with acute respiratory illness and laboratory-confirmed influenza infection to the odds of vaccination among outpatients with acute respiratory illness who test negative for influenza infection.

The overall, adjusted vaccine effectiveness estimates for influenza seasons from 2005-2016 are noted in the chart at http://www.cdc.gov/flu/professionals/vaccination/effectiveness-studies.htm.

It is important for everyone to get a flu vaccine every year. Flu is a serious disease that can lead to hospitalization and sometimes even death. Keep in mind, even healthy people can get very sick from the flu and spread it to others. I get my flu vaccine every year. It is very necessary when your labs handles thousands of influenza viruses.

Hi, Dr. Barnes! A few questions:

1. I've always wondered what goes into predicting the big strains that will hit and, thus, are included in the vaccine for a year. Is it mostly computational predictions based on how contagious a strain is? Are there any physical experiments performed that contribute to the predictions?
2. As someone allergic to eggs, it can be very difficult to locate the egg-free vaccine. Do you see us moving away from the egg based process in the future? What do you think are the scaled-up vaccine platforms of the future?
3. What limits the number of strains that can be included in the vaccine? If too many are included, do you get an unwanted immune response? Is it simply cost?

As an analytical chemistry PhD student really interested in biology/physiology, thank you for your time!

Au_Ag_CuSn

1. The influenza viruses in the seasonal flu vaccine are selected each year based on surveillance data indicating which viruses are circulating and forecasts about which viruses are the most likely to circulate during the coming season. This is one area where AMD can play a role in providing faster and more in depth surveillance circulating flu viruses. See more information about how AMD is used for flu surveillance here: http://www.cdc.gov/amd/project-summaries/influenza-cloud-surveillance.html.
2. In reference to the use of egg-based technology for flu vaccine, this year CDC's Advisory

Committee on Immunization Practices, or ACIP, updated their guidelines on egg allergy and receipt of influenza (flu) vaccines, found here: http://www.cdc.gov/flu/protect/vaccine/egg-allergies.htm. The updated recommendation came as a result of studies that have examined the use of both the nasal spray vaccine and flu shots in egg-allergic and non-egg-allergic patients indicate that severe allergic reactions in people with egg allergies are unlikely.You may also be interested in the development of a new cell-based flu vaccine as an alternative to the egg-based manufacturing process. Cell culture technology is potentially more flexible than the traditional technology, which relies upon adequate supply of eggs. In addition, the cell-based flu vaccine that uses cell-based candidate vaccine viruses (CVVs) has the potential to offer better protection than traditional, egg-based flu vaccines as a result of being more similar to flu viruses in circulation. More information about cell-based flu vaccines can be found here: http://www.cdc.gov/flu/protect/vaccine/cell-based.htm.

3. It's mainly protein load within the vaccine composition. Currently with the quad vaccine, all of the commonly circulating flu strains are covered and if too many are included you actually may get a poor immune response.

Hi Dr. Barnes. What's it like working with a virus that changes so rapidly from year to year?

nondirtysocks

Very challenging. But, I am part of a great team that is dedicated to the challenge influenza presents. So it is a pleasure to work alongside my other flu fighter colleagues within the CDC Influenza Division.

How would you convince someone who is staunchly against flu vaccines that they're a good thing?

My job gives out free flu vaccines during flu season and I've noticed that many of my coworkers don't take advantage of this for no other reason than "they're bad for you."

Glidow

Help address misconceptions about the flu. Remind people that a flu shot cannot cause flu illness. They should understand that anyone can get the flu, and each year, thousands of people in the United States die from flu, and many more are hospitalized. It's important to stress that the flu vaccine can keep people from getting flu, make flu illness less severe if they do get it, AND keep them from spreading flu to their family and other people that could be at high risk of severe flu complications.

As someone who gets the flu vaccine ever year and has never gotten the flu as a result, I have to thank you. Out of curiosity, what do you think the likelihood is of another killer flu outbreak like that of 1918, and how well could experts like you predict it?

Empigee

High five for getting a flu vaccine every year! It's my turn to say thank you. The science of forecasting flu activity is still in its infancy, but CDC continues to support it due to its potential public health value. Earlier this year CDC launched a website that provides forecasts of flu activity made by outside research groups. The website is a product of the "Epidemic Prediction Initiative," a joint effort between federal and external researchers to advance the science of forecasting infectious diseases, including influenza. The website, called "FluSight: Seasonal Influenza Forecasting," is available at predict.phiresearchlab.org. And you can see this season's flu forecasts at: https://predict.phiresearchlab.org/post/57f3f440123b0f563ece2576 You can find out more about the website and what CDC is doing at http://www.cdc.gov/flu/news/flu-forecast-website-launched.htm.

What about the flu virus causes it to mutate so quickly from year to year requiring a new vaccine every season? For example with chickenpox there is one virus and one vaccine, why then with the flu are there countless strains and a new vaccine every year? Also, if a new vaccine is being developed every year, how then is it tested for safety?

NomNom_nummies

As you know, influenza is a virus and can only replicate in living cells. Influenza viruses survive by infecting host cells, multiplying, and then exiting host cells. The enzyme influenza uses to copy itself is very error prone which causes the virus to rapidly mutate. Each host has its own defense mechanisms and these defenses are collectively referred to as environmental pressures. It's difficult to predict how a virus will mutate when attempting to get around a host's immune defenses, but the changes can happen rapidly, as you said.

Because flu viruses are constantly changing, the formulation of the flu vaccine is reviewed each year and sometimes updated to keep up with changing flu viruses. More information about how influenza viruses can change is available here https://www.cdc.gov/flu/about/viruses/change.htm

CDC and the Food and Drug Administration (FDA) closely monitor the safety of vaccines approved for use in the United States. CDC uses. There are two primary systems that monitor the safety of flu vaccines: One is the Vaccine Adverse Event Reporting System (VAERS) (an early warning system that helps CDC and FDA monitor problems following vaccination. Anyone can report possible vaccine side effects to VAERS. Generally, VAERS reports cannot determine if an adverse event was caused by a vaccine, but these reports can help determine if further investigations are needed), and the other is the Vaccine Safety Datalink (VSD) (A collaboration between CDC and nine health care organizations which allows ongoing monitoring and proactive searches of vaccine-related data). More information on flu vaccine safety can be found here: http://www.cdc.gov/flu/protect/vaccine/general.htm.

A bit of a layman question, but why are chicken embryos typically the go-to for flu vaccine cultivation? Is there an advantage from an efficiency standpoint or is geared more towards cost-effectiveness and mass production?

EnigmaticShark

Thanks for this question – it's one we get a lot! Flu vaccines have been made using an egg-based manufacturing process for more than 70 years. When making a vaccine for production you want to make sure you have a "clean" host to make the vaccine in. Since birds are the natural reservoir host for flu, you want to make sure you have a hard barrier between the two species you're using to make a vaccine. In this case, you want to make sure you use a cell line that is less likely to have human pathogens in it.

My great-grandfather died in the 1918 flu epidemic. What made that strain so deadly versus today's pathogens? Was it the lack of supportive therapy?

azpsych

The 1918 flu virus was a highly-pathogenic strain and therefore had a lot of features that are different from today's seasonal flu viruses, which made it particularly deadly. For more information, you can visit: http://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html

How long, do you think, until we have "programmable" viruses as nano machines?

praiserobotoverlords

CDC is using next generation sequencing, bioinformatics, predictive protein structural analysis, and synthetic genomics to design recombinant H3N2 candidate vaccine viruses (CVVs). The goal is to develop CVVs that replicate robustly in embryonated eggs while retaining their original antigenic profile. This will be accomplished by creating and analyzing a library of HA variants with substitutions in the receptor binding pocket, which are predicted to maintain antigenicity of wild type virus. MiSeq and PacBio NGS platforms will be used to identify the predicted substitutions that lead to the most efficient replication in eggs. In-house nucleotide polymorphism quantitation and co-variation algorithms needed to quantitate and phase/haplotype polymorphisms will be optimized and compared to publicly available algorithms. Ultimately, information obtained will be used to generate CVVs for the upcoming influenza seasons. The public health benefits of creating better matched CVV include fewer cases of influenza, fewer hospitalizations and fewer deaths.

Hi Dr. Barnes, first thank you for your work. I'm a Type 1 diabetic and have been getting the flu vaccine for almost my entire adult life. I can't remember the last time I had the flu and I'm also a frequent air traveler.

Q: In your experience, what is the best way to talk to people who think the vaccine is harmful? Specifically people who may not have a science background or seem to have strong biases based on anecdotal sources.

vrdeity

Flu vaccines are among the safest medical products in use. Hundreds of millions of Americans have safely received flu vaccines over the past 50 years, and there has been extensive research supporting the safety of flu vaccines. It is important to remind people that the flu vaccines cannot cause flu infection or flu illness.

Will vaccine production ever be entirely synthetic; supposing people care that we presently use biological products from living animals and then phage them? Tl;dr Will there ever be a vegan vaccine?

jimmyt3k

A vaccine requires a live host, we don’t have a synthetic cell that would allow production of a vegan vaccine.

medical student here thanks for doing the AMA

What new vaccines do you think will be available in the next 10-20 years?

carBoard

Collaborative efforts in the United States across the federal government and the private sector over the past 10 years or so have led to improved influenza vaccine technologies that have either expanded vaccine supply or improved vaccine effectiveness and in some cases accomplished both of these goals.

Recent advances have included the development of a high-dose vaccine, a trivalent flu vaccine made with adjuvant, quadrivalent vaccines, and the first recombinant flu vaccines.

A longer term goal for flu vaccines is the development of a single vaccine that would provide safe, effective and long-lasting immunity against a broad spectrum of influenza viruses, both seasonal and novel. A flu vaccine with these qualities is often referred to as a “universal flu vaccine.”

This task poses an enormous scientific and programmatic challenge, but a number of government agencies and private companies already have begun work to advance development of a universal flu vaccine.

Are there any longitudinal studies on how often the flu vaccine is a good match for that years most frequent flu virus?

Will AMD provide greater accuracy in determining what's going to be the most prevalent strain, or just in knowing what strain was most prevalent as the flu season progresses?

D_W_Hunter

CDC conducts studies to measure the benefits of seasonal flu vaccination each flu season to help determine how well flu vaccines are working. While vaccine effectiveness can vary, recent studies show vaccine reduces the risk of flu illness by about 50% to 60% among the overall population during seasons when most circulating flu viruses are like the vaccine viruses. The overall, adjusted vaccine effectiveness estimates for influenza seasons from 2005-2016 are noted in the chart at http://www.cdc.gov/flu/professionals/vaccination/effectiveness-studies.htm.

The genetic analysis of seasonal influenza essentially provides a moving window comparing recently circulating viruses to reference and vaccine candidates. The goal is to understand what is circulating, where and to what extent. Currently, all influenza viruses that are submitted to CDC are sequenced by my laboratory. With that information and other streams of data including viral surveillance data and antigenic characterization data we can make inferences regarding which viruses might predominate as the season progresses.

Do you suspect that AMD could reveal conserved regions for vaccine targeting?

redditouille

Great question! We’ve actually known conserved regions for a long time, even in using traditional sequencing technologies. AMD is helping us synthesize new vaccines that may be more effective at producing higher amount of vaccine and also better vaccines that are less likely to change when grown in eggs.

Hi Dr. Barnes! Do you get the flu vaccine every year? Which one? Thanks for all you are doing. Influenza is such a nightmare.

kleinerschatz

Absolutely! It is very necessary when your labs handles thousands of influenza viruses. It is given out here at the CDC clinic. Current offering is the quadrivalent vaccine.

Do you have any insight on the universal vaccine that was developed? Looking at some of themany sources of information shows tests on humans have already happened and proven successful, is there any reason this has gone out as the main vaccine? Or is it a waiting game on federal approval?

ShadowedPariah

Great question! Yes, I can provide some insight. A longer-term goal for seasonal flu vaccines is the development of a single vaccine, or universal vaccine, that provides safe, effective, and long-lasting immunity against a broad spectrum of different flu viruses (both seasonal and novel). Right now, CDC is a part of a board inter-agency partnership coordinated by the Biomedical Advanced Research and Development Authority (or BARDA) that supports the advanced development of new and better flu vaccines. These efforts have already yielded important successes (i.e. a high dose flu vaccine specifically for people 65 years and older that creates a stronger antibody response), but a part of this effort is the eventual development of a universal vaccine. A number of government agencies and private companies have already begun work to advance this type of vaccine's development, but, as you can imagine, this task poses an enormous scientific and programmatic challenge.

Hi Dr. Barnes! Thank you for all your work on flu vaccines.

So I work in a medical office and we had to send one patient to the hospital because she was so sick. Turns out she had influenza type A, even though she had a flu shot. What factors play into flu shot effectiveness? Was this a different strain of the flu?

whalesERMAHGERD

Hello, thanks for your question. How well the flu vaccine works each season can vary. Unfortunately, there's still a possibility that someone can get the flu, even if he/she got vaccinated. Flu vaccine's ability to protect a person depends on several factors, like the age and health status of the person being vaccinated and also the similarity or match between the viruses in the seasonal flu vaccine and those that are circulating in the community. If the viruses in the flu vaccine and the viruses that are circulating are closely matched, then vaccine effectiveness is higher. If they aren't closely matched, vaccine effectiveness can be reduced.

For this season, three-component flu vaccines are recommended to contain: A/California/7/2009 (H1N1)pdm09-like virus, A/Hong Kong/4801/2014 (H3N2)-like virus, and a B/Brisbane/60/2008-like virus (B/Victoria lineage). Four component vaccines are recommended to include the same three, plus an additional B virus: B/Phuket/3073/2013-like virus (B/Yamagata lineage). But there are many flu viruses and they are constantly changing. It's important to remember that even when the viruses are not closely matched, the flu vaccine can still protect many people and prevent flu complications.

Does contracting some flu viruses endow a person with any resistance to more virulent strains that may occur in the future?

Holden_Coalfield

Past studies indicate that flu vaccination can sometimes provide some cross-protective immunity against other very similar influenza viruses.

The same is true for immune protection gained by being infected with one influenza virus and being protected later from infection by other similar influenza viruses. However, the presence and level of cross-protective immunity is subject to many factors including but not limited to the characteristics of the flu viruses, age and health of the host, and when the first infection or vaccination occurred.

I've heard a lot about scientists having to "choose" each year which influenza virus the world should be vaccinated against, and sometimes it's the wrong choice. Is it too complex/expensive to cover more

than one base and give a cocktail, or are there other good reasons not to combine them?

tailsuser2

Hello! The seasonal flu vaccine is made to protect against the three or four flu viruses that research indicates are most likely to spread and cause flu illness among people during the upcoming flu season. Flu viruses are constantly changing, so the flu vaccine composition is reviewed each year and is updated as needed based on which flu viruses are making people sick, the extent to which those viruses are spreading, and how well the previous season's vaccine protected against those viruses.

Hi Dr. Barnes,

I just graduated with my B.S. In microbiology, and I'm now going to school to get my masters in epidemiology. Infectious disease is basically my life, and my dream job would be to work in the CDC. Do you have any tips for getting a job there? Or places you would have rather worked? Thanks so much!!

Lyssavirus32

That's great to hear! The CDC offers many opportunities for students and college graduates to get their foot in the door here. Check out the programs and fellowships available- http://www.cdc.gov/jobs/pathways.html. Also, I would suggest setting up an account with https://www.usajobs.gov/ and searching for available CDC opportunities that interest you.

I have a child who is on the autism spectrum and is also terrified of needles. I haven't been able to convince him to do the flu shot, but the rest of the immediate family has gotten it. are his chances of getting the flu lowered since he is surrounded by vaccinated people? I also have heard about adverse reactions to vaccines and wonder if there are some people who should not get the flu shot (i.e. immunocompromised) and how best to protect them from getting the flu.

osuzannesky

Hello, thank you for your question! CDC recommends that everyone 6 months of age and older receive an annual flu vaccine, with rare exceptions. People who can't get the flu vaccine includes: Children younger than 6 months, since they are too young to get a flu shot and individuals with severe, life-threatening allergies to flu vaccines or any ingredient(s) in the vaccine. Family members or friends that are around child should get a flu vaccine, and you should make sure that others in the household also get vaccinated each year. By getting vaccinated, you will be less likely to get the flu and therefore less likely to spread the flu to your child.

This may be too mundane for Dr. Barnes but maybe someone here knows.

The last three shots I've gotten (2 flu, 1TDaP) have left a hot, hard, raised, red welt on my arm over 3" across

I want to get the flu shot and am wondering if there are any I should seek out or avoid - IM vs. ID, IIV vs. LAIV, thimerosal? Thanks!

schnoodlebed

Thanks for the question! Any vaccine can cause side effects. For the most part these are minor (for example, a sore arm or low-grade fever) and go away within a few days. CDC has a list of vaccines

licensed in the United States and common side effects that have been associated with each of them. This information is copied directly from CDC's Vaccine Information Statements, which in turn are derived from the Advisory Committee on Immunization Practices (ACIP) recommendations for each vaccine. You can find that at http://www.cdc.gov/vaccines/vac-gen/side-effects.htm. Remember, vaccines are continually monitored for safety as well.

You may also want to reach out to your healthcare provider and seek their opinion, especially about if there is a specific type of flu vaccine you should receive. This year CDC recommends that everyone 6 months and older get a flu shot; the nasal spray is not recommended because of concerns over its effectiveness.

The hemagluttinin part of influenza viruses seems to be the place that some are hoping to target for a "universal" vaccine. How much do you participate in giving them info from AMD tech?

jamesian

Thanks for your question! A longer-term goal for seasonal flu vaccines is the development of a single vaccine, or universal vaccine, that provides safe, effective, and long-lasting immunity against a broad spectrum of different flu viruses (both seasonal and novel). Right now, CDC is a part of a board inter-agency partnership coordinated by the Biomedical Advanced Research and Development Authority (or BARDA) that supports the advanced development of new and better flu vaccines. These efforts have already yielded important successes (i.e. a high dose flu vaccine specifically for people 65 years and older that creates a stronger antibody response), but a part of this effort is the eventual development of a universal vaccine. A number of government agencies and private companies have already begun work to advance this type of vaccine's development, but, as you can imagine, this task poses an enormous scientific and programmatic challenge.

What ethics considerations do you and your colleagues consider when it comes to developing or releasing a vaccine. Is there any debate along the lines of 'should we' as opposed to 'can we'?

UKisBEST

Thanks for your question. Flu vaccines are among the safest medical products in use. Hundreds of millions of Americans have safely received flu vaccines over the past 50 years, and there has been extensive research supporting the safety of flu vaccines. Like any medical product, vaccines can cause side effects. Side effects of the flu vaccine are generally mild and go away on their own within a few days.

Where do you find (or do you design) the algorithms that you use to sort signal from noise in genomics/proteiomics?

jamesian

We just recently released a publication on this, and IRMA is the assembly platform that we developed here at CDC for that purpose. You can find more information on this here: http://bmcgenomics.biomedcentral.com/articles/10.1186/s12864-016-3030-6

Is there any work being done to artificially generate vaccines for possible future mutations of strains based on computer modeling?

hcker2000

CDC and other WHO Collaborating Centers for Influenza routinely develop candidate vaccine viruses in response to circulating influenza viruses that represent a possible threat to public health. CDC assesses the potential pandemic risk of viruses using the IRAT (Influenza Risk Assessment Tool) http://www.cdc.gov/flu/pandemic-resources/tools/risk-assessment.htm

WHO maintains lists of available candidate vaccine viruses on their web site: http://www.who.int/influenza/vaccines/virus/en/.

Also with regard to computer modeling, CDC has been able to use synthetic genomics (reverse genetics) to develop candidate influenza vaccine viruses. http://www.cdc.gov/flu/avianflu/candidate-vaccine-virus.htm When human infections with a new avian influenza A (H7N9) virus were first reported in China in 2013, CDC did not immediately receive a representative strain of the H7N9 virus for analysis. CDC was still able to move forward with candidate vaccine virus production by using the gene sequence China had uploaded to GISAID as a starting point.

Hi Dr. Barnes, in most countries other than the U.S. and Canada, everyone is not actively encouraged to get a flu shot yet we don't seem to hear of widespread flu outbreaks on a regular basis. Why is that?

sharknado1234

Though you may not hear about them on the news, other countries around the world experience flu epidemics like the seasonal one the U.S. and Canada see each Winter. In tropical regions, influenza may occur throughout the year, causing outbreaks more irregularly. According to the World Health Organization worldwide annual epidemics are estimated to result in about 3 to 5 million cases of severe illness, and about 250,000 to 500,000 deaths. In industrialized countries most deaths associated with influenza occur among people age 65 or older. Epidemics can result in high levels of worker/school absenteeism and productivity losses. Clinics and hospitals can be overwhelmed during peak illness periods. The effects of seasonal influenza epidemics in developing countries are not fully known, but research estimates indicate that 99% of deaths in children under 5 years of age with influenza related lower respiratory tract infections are found in developing countries.

Is the flu different in different countries? I have friends from America coming to visit me in the Philippines next year, so is the flu shot there going to adequately protect them from the flu here, or should they get a flu shot in both countries?

Memories_of_You

Thanks for your questions. Yes, exposure to flu can depend on the time of year and the destination. In the Northern Hemisphere, the flu season can begin as early as October and can last as late as April or May. But in the temperate regions of the Southern Hemisphere, flu activity typically occurs during April through September. In the tropics, flu activity occurs throughout the year. Travelers in the Northern and Southern Hemispheres can be exposed to flu during months that fall outside of these that I've provided above, especially when traveling as part of large tourist groups (e.g. on cruise ships) that include people from areas of the world where flu viruses are circulating. The vaccine viruses recommended for inclusion in the 2016-2017 Northern Hemisphere flu vaccines are the same vaccine viruses that were chosen for inclusion in 2016 Southern Hemisphere seasonal flu vaccines.

1. How long have you been doing this?
2. What got you interested in this field?

Chief_Rocket_Man

I came to CDC Influenza Division in 2007 after my postdoc in Human Genetics at Emory University. The job at CDC was to build an influenza genetic lab helping the Influenza Division at CDC by increasing genetic surveillance and collaborating with other investigators within the division. The job was too good to pass up. Building a team at the CDC is an opportunity that doesn't come often. But I came to influenza through a circuitous route, I studied biochemistry and molecular biology of pine trees for my PhD. -strangely, that work is where I learned how to set up effective sequencing strategies which helped me land the Job here at CDC. I've been working on Influenza ever sense. I love it, influenza is fascinating.

Hi Dr. Barnes! Thanks for doing this AMA.

What is your schedule like on a daily basis? Are you (hands-on) involved in any daily research processes like running biotechnological tests? I am fascinated by research and would like to know what it's like day-to-day.

Amandalicious9

What is your schedule like on a daily basis? Up until recently, I did run my own experiments in the laboratory. The last two years have been exceptionally busy and I have had to step back and let my lab staff take over. I help outline experiments we need to complete, write grants, reports etc. I have hopes to get back into the lab but don't get to as often as I'd like.